CLAIMS

1.   A method of calculating an inverse transform for transform coded data (200), said coded data being arranged in groups of coefficients (202,204,206), wherein at least one coefficient is selectively modified to control mismatch, wherein the inverse transform is performed selectively so as to apply abbreviated processing to groups composed entirely of zero-valued coefficients (204), and wherein, for the purpose of selecting whether abbreviated processing is to be applied, a data group (206) is considered a zero-valued group if the only non-zero coefficient contained therein is a coefficient modified for mismatch control.

2.   A method as claimed in claim 1 wherein said transform coded data is discrete cosine transform coded data.

3.   A method as claimed in claim 2 wherein said discrete cosine transform coded data forms part of MPEG-1 or MPEG-2 encoded video data.

4.   A method as claimed in any preceding claim wherein the data is arranged in a two-dimensional array.

5.   A method as claimed in claim 4 wherein said two-dimensional array is an 8x8 array.

6.   A method as claimed in any preceding claim wherein a two-pass approach of multiple 1-D inverse transforms is applied.

7.   A method as claimed in claim 6 wherein each data group (202,204,206) is a column or a row of said array, depending on whether vertical inverse transform or horizontal inverse transform is performed first.

8.   A method as claimed in claim 6 or 7 wherein the second pass inverse transform routine is made on the basis of the combinations of non-zero valued groups (202).

9.   A method as claimed in claim 8 wherein a number of variations of a second pass process executable code are pre-stored, each variation corresponding to a combination of non-zero groups (202) present in the first pass, the code determining on which coefficients calculation is performed.

10.   A method as claimed in claim 9 wherein the second pass code is adapted to ignore data from unprocessed input groups.

11.   A method as claimed in any of claims 1 to 5 wherein a direct 2-D implementation is used.

12.   A method as claimed in claim 11 wherein the groups assumed zero are 2-D blocks of coefficients.

13.   A method as claimed in any of claims 4 to 12 wherein the coefficient modified for mismatch control is the last coefficient, that is the bottom right hand corner coefficient of the array.

14.   A method as claimed in any preceding claim wherein an inverse transform of the data group containing the coefficient modified for mismatch control is pre-calculated and used in calculating the inverse transform.

15.   A method as claimed in any preceding claim wherein the inverse transform for each data group is calculated only for data groups (202) for which, discounting any mismatch modification, there is a non-zero coefficient and wherein, if mismatch is indicated, pre-calculated output values are used for the data group (206) having the modified coefficient.

16.   A method as claimed in any of claims 1 to 14 wherein the number of non-zero data groups (202) and each of their positions is determined before performing the inverse transform for any of the groups and a routine is selected from a number of possible routines, depending on the configuration of non-zero groups (202) and their positions.

17.   A method as claimed in claim 16 wherein:
-    where there is at least one non-zero group (202) outside a subset of said groups, the inverse transform is calculated for all groups (202,204,206); and
-    where there are no non-zero groups (202) outside said subset, then the inverse transform is calculated for said subset and not for the remaining groups, and, if the modified coefficient is non-zero, pre-calculated values are used to reproduce the effect of the modified coefficient ([7,7]) in the inverse transform.

18.   A method as claimed in claim 17 wherein said subset comprises the first three groups.

19.   A method as claimed in claim 17 or 18 wherein said routines are further optimized such that:
-    where the only non-zero data groups (202) is the first group, the inverse transform is calculated in two dimensions for the non-zero data group (202) only, and if the modified coefficient is non-zero, pre-calculated values of the effect the modified coefficient has on each output value are then added; and/or
-    if only the DC coefficient (420) is non-zero, all output values are set to the value of the DC coefficient and if the modified coefficient is non-zero, pre-calculated values of the effect the modified coefficient has on each output value are then added.

20.   Decode apparatus comprising means for calculating an inverse transform (114) for transform coded data, said coded data being arranged in groups of coefficients (202,204,206), wherein at least one coefficient is selectively modified to control mismatch, wherein there is further provided means for performing selectively the inverse transform so as to apply abbreviated processing to groups (204) composed entirely of zero-valued coefficients, and wherein, for the purpose of selecting whether abbreviated processing is to be applied, a data group (206) is considered a zero-valued group if the only non-zero coefficient contained therein is a coefficient modified for mismatch control.

21.   Apparatus as claimed in claim 20 wherein said transform coded data is discrete cosine transform coded data.

22.   Apparatus as claimed in claim 21 wherein said discrete cosine transform coded data forms part of MPEG-2 encoded video data.

23.   Apparatus as claimed in any of claims 20 to 22 wherein the data is arranged in a two-dimensional array (200).

24.   Apparatus as claimed in claim 23 wherein said two-dimensional array is an 8x8 array (200).

25.   Apparatus as claimed in any of claims 20 to 24 wherein said apparatus applies a two-pass approach of multiple 1-D inverse transforms.

26.   Apparatus as claimed in claim 25 wherein each data group is a column or a row of said array, depending on whether vertical inverse transform or horizontal inverse transform is performed first.

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27.   Apparatus as claimed in claim 25 or 26 wherein said apparatus is arranged such that the second pass inverse transform routine is made on the basis of the combinations of non-zero valued groups (202).

28.   Apparatus as claimed in claim 27 wherein there is provided means for pre-storing a number of variations of a second pass process executable code, each variation corresponding to a combination of non-zero groups (202) present in the first pass, the code determining on which coefficients calculation is performed.

29.   Apparatus as claimed in claim 28 wherein the second pass code is adapted to ignore data from unprocessed input groups.

30.   Apparatus as claimed in any of claims 20 to 24 wherein said apparatus is arranged to use a direct 2-D implementation.

31.   Apparatus as claimed in claim 30 wherein the groups assumed zero are 2-D blocks of coefficients.

32.   Apparatus as claimed in any of claims 23 to 31 wherein the coefficient modified for mismatch control is the last coefficient, that is the bottom right hand corner coefficient of the array.

33.   Apparatus as claimed in any of claims 20 to 32 wherein there is provided means for pre-calculating an inverse transform of the data group containing the coefficient modified for mismatch control (206), said pre-calculation being used in calculating the inverse transform.

34.   Apparatus as claimed in any of claims 20 to 33 wherein there is provided means for calculating the inverse transform for data groups (202) only when any of the coefficients, discounting any modification due to mismatch control, are non-zero and wherein, if mismatch is indicated, pre-

calculated output values are used for the data group having the modified coefficient (206).

35.   Apparatus as claimed in any of claims 20 to 33 wherein there is provided means for determining the number of non-zero data groups (202) and each of their positions before performing the inverse transform for any of the groups, and means for selecting a routine from a number of possible routines, depending on the number of non-zero groups and their positions (202).

36.   Apparatus as claimed in claim 35 wherein said apparatus is arranged such that:
- where there is at least one non-zero group (202) outside a subset of said groups, the inverse transform is calculated for all groups (202,204,206); and
- where there are no non-zero groups (202) outside said subset, then the inverse transform is calculated for said subset and not for the remaining groups, and, if the modified coefficient is non-zero, pre-calculated values are used to reproduce the effect of the modified coefficient ([7,7]) in the inverse transform.

37.   Apparatus as claimed in claim 26 wherein said subset comprises the first three groups.

38.   Apparatus as claimed in claim 36 or 37 wherein the apparatus is arranged such that:
- where the number of non-zero data groups (202) is one, the inverse transform is calculated in two dimensions for the non-zero data group only, and if the modified coefficient is non-zero, pre-calculated values of the effect the modified coefficient has on each output value are then added; and/or
- if only a DC coefficient (420) is non-zero, all output values are set to the value of the DC coefficient and if the modified coefficient is

non-zero, pre-calculated values of the effect the modified coefficient has on each output value are then added.

5   39.   A record carrier wherein are recorded program instructions for causing a programmable processor to perform the steps of a method according to any of claims 1 to 19, or to implement an apparatus according to any of claims 20 to 38.